Volume 14 Study AFS-41-1

STATE OF ALASKA

William A. Egan, Governor

Annual Progress Report for

A Study of Chinook Salmon in Southeast Alaska

by

Paul D. Kissner, Jr.

ALASKA DEPARTMENT OF FISH AND GAME

James W. Brooks, Commissioner

DIVISION OF SPORT FISH

Rupert E. Andrews, Director

Howard E. Metsker, Coordinator

* This project was financed in part with Anadromous Fish Act (PL 89-304) funds through the Bureau of Sport Fisheries and Wildlife.

TABLE OF CONTENTS

RESEARCH PROJECT SEGMENT

State: Alaska

Project No.: AFS-41-1 Project Title: A Study of Chinook Salmon in Southeast Alaska.

Job No.: AFS-41-1

Period Covered: July 1, 1972 to June 30, 1973

ABSTRACT

The mean count and measurement of circuli to the first freshwater annulus of chinook, Oncorhynchus tshawytscha, scales increases in river systems sampled from north to south. The three Southeast chinook systems sampled had a mean count of 9.40 while chinook of non-Alaskan origin had a mean count of 12.85. Results of simulated sampling via the computer indicate that, to the nearest 10%, the Juneau saltwater sport catch sample is composed of 90% Alaska chinook salmon and 10% non-Alaskan, while the Sitka saltwater sport catch is composed 100% of chinook of non-Alaskan origin.

Separation of maturing chinook of various subtypes appears possible, if gonad samples are collected in different areas over an extended time and gonad weights correlated to body weight.

Investigation of important chinook spawning tributaries indicates that no population is of sufficient magnitude to justify an egg take or rearing fish transplant at the present time.

Age analysis of chinook harvested in various fisheries is presented.

RECOMMENDATIONS

Research

1. A study of the present status of native chinook stocks should be undertaken. This would include determining areas of harvest of mature and immature native chinook in various fisheries throughout Southeast, establishing index areas for monitoring of escapements in important systems and investigating the effects of gillnets on our stocks.

2. Analysis of scales collected in the future should include counting and/or measuring circuli of the following areas: (1) to the freshwater annulus; (2) plus growth; (3) first five ocean circuli; (4) to the annulus of the first ocean year. Results should be summarized by multivariate analysis to determine if combinations of certain counts and measurements will decrease the scales non-classifiable by only analysis to the freshwater annulus.

3. Next year scale samples should be analyzed from about twenty major chinook systems in Alaska, British Columbia and Washington in an attempt to verify this year's preliminary findings.

4. Collections should also be made in sport and commercial troll fisheries throughout Southeast in an effort to determine the contribution of our native chinook stocks to various fisheries.

5. Methods of establishing a native brood stock for enhancement purposes, such as transplanting and artificial spawning of gillnet caught chinook, should be attempted.

<u>Management</u>

1. Tagging (Kissner, unpublished) and scale analysis indicate a high percentage of local chinook rear in the marine environment near the Juneau area. Escapement data indicate that native stocks have been severely reduced and that it is therefore recommended that the chinook commercial and sport fish harvest be reduced for the statistical areas 111 and 115.

2. Escapements have declined in the Situk watershed and it is recommended that the sport fish bag limit be reduced.

3. Based on spawning ground surveys no population of chinook in Southeast is of sufficient magnitude to warrant or justify an egg take or rearing fish transplant.

OBJECTIVES

1. Develop methods of determining the contribution of Alaskan stocks of chinook to southeastern Alaska fisheries.

2. Determine the feasibility of increasing the sport catch of chinook salmon by pond rearing of young or stocking of smolts.

INTRODUCTION

Migration studies conducted by the Alaska Department of Fisheries during the early 1950's indicated that a wide mixture of chinook salmon stocks from as far south as Oregon migrate through waters of southeast Alaska. Tag recoveries indicated that stocks in outside water were highly dependent on river systems in British Columbia and Washington while inside waters contained a mixed population of Alaska and British Columbia origin.

Commercial harvest of chinook salmon has declined in both inside and outside waters of southeast Alaska. The production in inside waters has decreased from 299,813 chinook in the early 1950's, to 90,072 in 1972. Since no method of apportioning the origin of the commercial catch had been devised, it was difficult to determine if the reduced harvest was caused by declining native populations or depletion of systems to the south. In the past the only indication of the condition of our native stocks were several restricted gillnet fisheries and limited aerial estimates conducted during spawning.

Studies undertaken this year were designed to determine if racial separation of chinook salmon was feasible by biological characteristics. In conjunction with this, age analysis of chinook harvested in various fisheries was completed. A second objective was to determine the feasibility of enhancing chinook stocks in various areas.

TECHNIQUES USED

Chinook scales, reproductive tracts, lengths and weights were collected from various sport and commercial fisheries throughout southeast Alaska.

Scales were taken in the preferred area, two rows above the lateral line and slightly posterior to the insertion of the dorsal fin. Because of the high occurrence of regeneration in chinook scales, five extra scales were taken from each side of an individual near the preferred area and placed in a numbered coin envelope.

Scales were later examined under binocular miscroscope and the first complete scale was soaked in detergent, cleaned and mounted on a numbered gum card. They were pressed in cellulose acetate and analyzed under a Eberbach micro-projector at a magnification of 80X.

Circulus counts and measurements were made along the 20° dorsoradial line of the scale. Clutter and Whitesel (1956) found that on sockeye salmon, *Oncorhynchus nerka*, scales circuli in this area were more complete and widely spaced.

The following procedure was used in counting and measuring circuli:

1. Determine the last freshwater circulus before the annulus.
2. Measure the distance in millimeters from the inside edge of the first circulus to the outside edge of the last freshwater circulus before the annulus.
3. Count the circuli from the focus to the last freshwater circulus before the annulus.
4. Determine the outside edge of the first ocean annulus.
5. Measure the distance in millimeters from the inside edge of the first marine circulus to the outside edge of the first marine annulus.
6. Count the circuli from the first marine circulus to the outside edge of the first marine annulus.

The annulus is defined as the area of incomplete, closely spaced circuli followed by complete, widely spaced circuli.

Reproductive tracts were dissected from chinook sampled in the round. Comparisons of egg diameters and weights, and testis weights before and after freezing indicated that freezing did not alter the size or the weight of reproductive organs; therefore samples were usually frozen to perserve them for shipment to Juneau and later analysis.

Five eggs, randomly selected, were dissected from each side of a female reproductive tract. Each egg was measured to the nearest 1/10th of a millimeter under a binocular miscroscroscope utilizing a micrometer disc. Total weight of each male and female reproductive tract was determined to the nearest 1/10th gram. A maturity index, which is a ratio of gonad weight to body weight, was calculated. Mid-eye to fork of tail length was recorded to the nearest five millimeters and dressed and/or round weight was determined to the nearest .44 kilogram.

FINDINGS

Racial Analysis

Several past attempts have been made to separate chinook stocks in Alaska by biological characteristics. A 1963 study compared morphometric and meristic characters of adults from the Avik River in Washington to the Alsek, Chilkat, Naknek and Karluk rivers in Alaska (Rowland, 1963). The author concluded that there were only minor differences in various counts.

Rowland (1969) also analyzed scales from chinook stocks of the Taku, Alsek, Copper and Anchor rivers. Average circuli counts and length of radii measurements indicated minor differences, but the degree of overlap was too great to make reliable classification as to river or origin.

After reviewing the literature it was decided that initial emphasis should be placed on analysis of scales, reproductive tracts, enzymes and x-ray spectroscopy system.

Scale Analysis

Separation of stocks by analysis of scales is not a new concept. Henry (1961), Mosher (1963) and Isakssoni (1970) have shown that in certain specific situations partial separation of sockeye salmon stocks is possible by analysis of scales. Bohn and Jensen (1971) have attempted and failed to separate tributary races of wild spring chinook in the Columbia River by measuring and counting circuli. They did, however, achieve fair success in separating wild and hatchery chinook in the Willamette River system.

Mosher (1972) stated that of about 50 different features studied the best features for racial studies appear to be the freshwater and first ocean zones of a scale. Emphasis was thus placed on analyzing these features.

Scales were collected from gillnet and troll fisheries located near the outlets of several major chinook salmon systems in southeast Alaska. Gonads were examined to confirm that only mature fish were collected. Sampling was conducted weekly from May 1 to June 15 on the Taku River and once on the Stikine and Chilkat rivers.

Scale samples collected between 1960 and 1967 from the Skeena and Fraser rivers, two of the most productive chinook systems in Canada, were secured from Fisheries Research Board of Canada and the Department of the Environment.

Columbia River chinook scales were collected in major tributaries during 1966 and were analyzed and summarized by Bohn and Jensen (1971). Their methods of counting circuli were identical to the method used here. The Snake River drainage was eliminated from the data analysis as this stock is at a low level of abundance (Jensen, personal communication).

One assumption of this study was that circulus counts of spring chinook do not show large variations annually. Analysis of the Taku River sample showed that the 1967 brood year had a mean circuli count of 9.76 and the 1966 brood year 9.15. Rowland found that the mean count for the 1955 and 1956 brood years were 9.40 and 10.26, respectively. Bohn and Jensen (1971) tested various age groups in the Columbia and concluded that there was no evidence to justify dividing the samples by brood year.

Rowland (1969), and Bohn and Jensen (1971) also found no significant difference in numbers of circuli between sexes.

I therefore combined brood years and sexes during analysis.

Analysis of the freshwater growth zone of known origin spring chinook scales indicates that partial separation of stocks should be possible. Differences do occur between stocks studied of Alaskan and non-Alaskan origin in mean number of circuli (Table 1). These differences do not appear to be great enough to separate individual river systems but are of sufficent magnitude for classification of Alaskan and non-Alaskan chinook in a mixed stock fishery.

The mean count and measurement of circuli to the first freshwater annulus of chinook salmon scales increased in river systems sampled from north to south. Three Southeast chinook systems had a mean count of 9.40 while chinook of non-Alaskan origin had a mean count of 12.85. Major overlap of counts between systems occurred only at 10-12 circuli. Accordingly, counts of less than 10 circuli would have a high probability of being of Alaskan origin and greater than 12 circuli of non-Alaskan origin.

A minor difference in measurement of circuli to the annulus was also observed (Fig. 1). The mean measurement in Alaska systems was 1.48 mm and non-Alaskan systems 1.85 mm.

Counts and measurements of ocean circuli showed overlap but will be included in future analysis to determine if multivariate analysis will further aid in separation of stocks.

Circuli counts of Alaskan and non-Alaskan chinook were then compared with circuli counts of chinook caught in several saltwater sport fisheries in Southeast (Fig. 2). The Sport Fish Division biometrician analyzed the data by simulated sampling via the computer. Simulated sampling basically involves drawning repeated samples from the theoretical probability distributions, which represent the actual distributions of the variables involved. With simulated samples of 10,000 chinook salmon each, he varied the proportion of non-Alaskan salmon from 0.00 to 1.00 in increments of 0.10 and calculated the relative frequencies of the numbers of circuli in the combined sample of Alaskan and non-Alaska salmon that resulted in each of the eleven cases. He also calculated the relative frequencies of number of circuli for the Juneau sport catch sample and the Sitka sport catch sample and compared these frequencies to the frequencies simulated in each of the eleven cases by calculating an average difference ("average error") of the frequencies in each circuli class for each of the eleven cases considered. This statistic indicates how closely the Juneau and Sitka saltwater sport catch relative frequencies are matched by the eleven simulated catch frequency distributions for the various assumed proportions of non-Alaskan chinook salmon. The best match occurs where the average error has its minimum value.

The smallest average errors occur for 10% non-Alaskan chinook salmon in the Juneau sport catch sample and for 100% non-Alaskan chinook in the Sitka sport catch sample (Table 2). The results of this simulation indicate that, to the

Table 1. Summary of Chinook Salmon Circuli Data.

NUMBERS OF FISH

No. of Circuli	Non-Alaska Rivers*	Alaska Rivers**	Juneau Sport Catch	Sitka Sport Catch
5	---	1	---	---
6	---	4	6	---
7	7	36	27	---
8	7	49	33	---
9	38	72	28	---
10	82	72	26	4
11	84	37	14	4
12	100	20	10	2
13	82	8	4	8
14	58	4	3	6
15	57	---	2	5
16	34	---	1	1
17	27	---	2	2
18	12	---	2	---
19	10	---	1	---
20	8	---	1	1
21	4	---	---	1
22	2	---	---	1
23	3	---	---	---
24	---	---	---	---
25	1	---	---	---
26	---	---	---	---
27	---	---	1	---
28	---	---	1	---
Totals	616	303	162	35
Mean No. of Circuli	12.85	9.40	9.75	13.83
Std. Dev. of Circuli	2.89	1.65	3.27	2.88

*Columbia River - 391
Fraser River - 120
Skeena River - 105

**Stikine River - 54
Taku River - 210
Chilkat River - 39

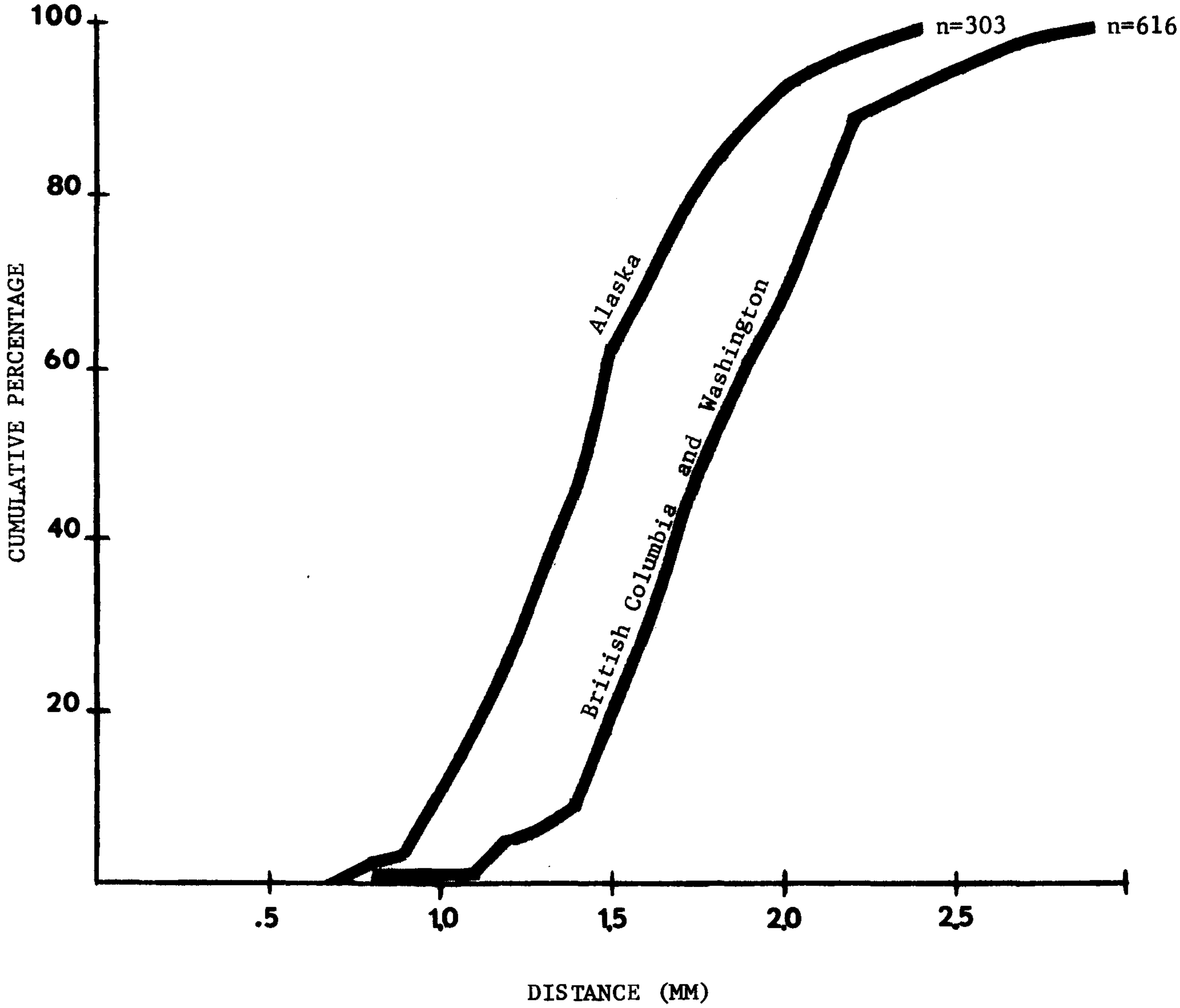

Figure 1. Measurement to the first freshwater annulus of known origin chinook salmon scales, 1972.

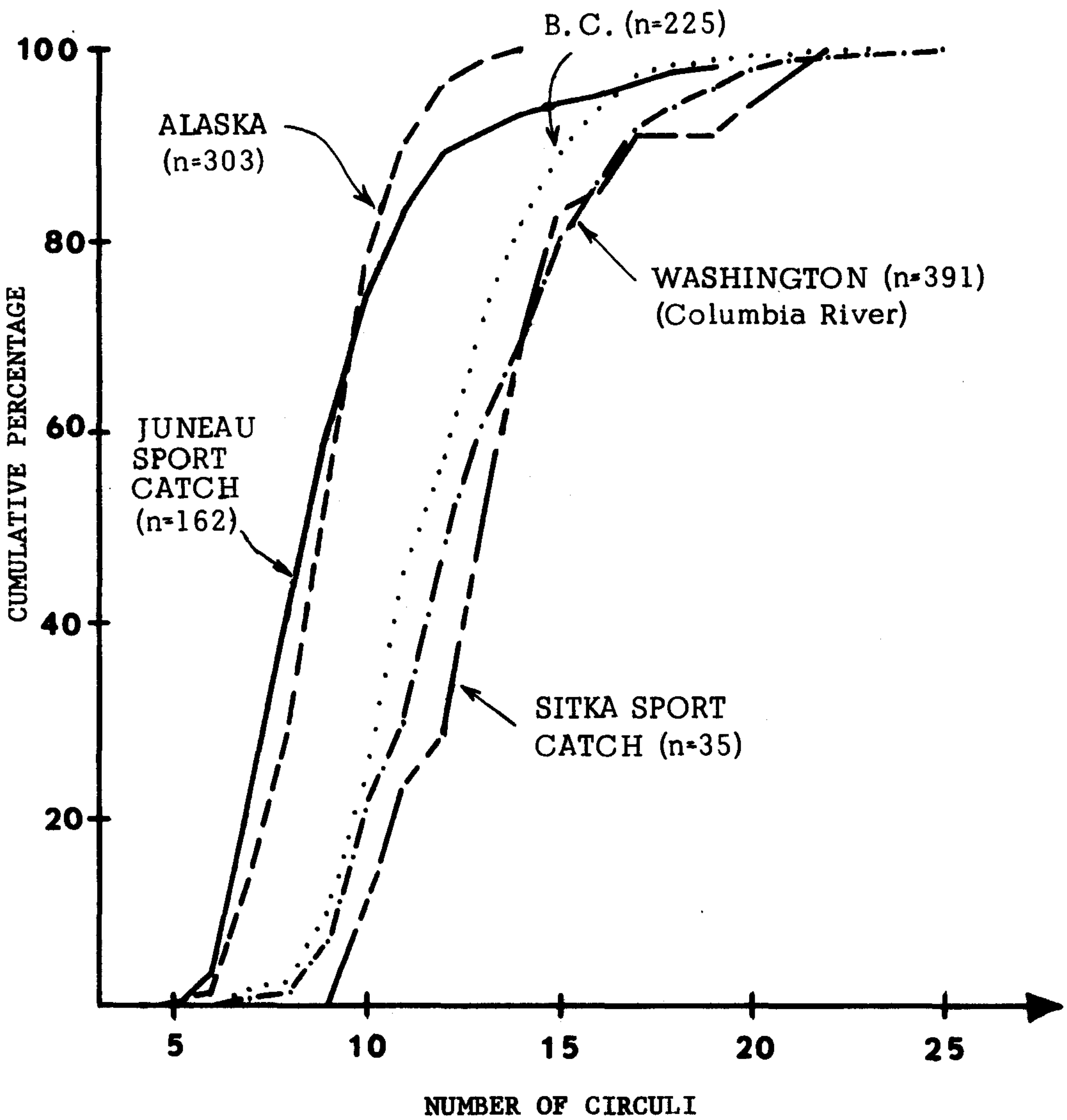

Figure 2. Relative cumulative frequencies of chinook salmon circuli counts, to the first freshwater annulus, 1972.

Table 2. Chinook Salmon Sport Catch Simulation Summary

Case Number	Proportion Non-Alaskan	Average Errors: Juneau Sport Catch	Average Errors: Sitka Sport Catch
1	0.00	1.41	4.87
2	0.10	1.32*	4.55
3	0.20	1.40	4.23
4	0.30	1.53	3.85
5	0.40	1.73	3.55
6	0.50	2.01	3.34
7	0.60	2.43	3.01
8	0.70	2.82	2.73
9	0.80	3.18	2.38
10	0.90	3.57	2.30
11	1.00	3.95	1.99*

* Smallest calculated average difference of catch frequencies.

nearest 10%, the Juneau sport catch sample is composed of 90% of Alaskan chinook salmon and 10% non-Alaskan while the Sitka sport catch is composed 100% of chinook of non-Alaskan origin.

Reproductive Tracts

Reproductive tracts were collected in various inside and outside fisheries in Southeast to determine if maturing spring and fall chinook could be reliably separated. Spring chinook are usually sub-2, spending one year in freshwater after emergence and fall chinook commonly sub-1, migrating to the estuary normally within 120 days of emerging. Classification of subtype in a mixed fishery by scales alone is often extremely difficult (Jensen, personal communication). Parker and Kirkness (1956) in their study of the offshore troll fishery state, "considerable room for doubt of correct interpretation exists, particularly in distinguishing a stream type from an ocean type nucleus". Since only the spring, or sub-2, are produced in Alaskan river systems, correct classification of the nucleus would achieve partial stock separation.

Rich (1926) conducted a study on female chinook near the Columbia River; he felt separation of subtype was possible by scales alone. Interpretation of subtype was probably less difficult during that period as hatchery contributions presently make separation difficult.

Gonads and scales were collected during May in the Taku River gillnet fishery, where most all the chinook harvested are maturing "springs." Reproductive tracts and scales were also collected in outside waters between Sitka and Noyes Island. Past tagging indicated that stocks in this area contained a substantial percentage of the fall variety. During this time collections were made in the Haines and Ketchikan Salmon Derbies; during late July, on the Fairweather grounds and Juneau Salmon Derby.

Analysis of reproductive tracts collected in the Taku Inlet gillnet fishery indicate that maturing spring chinook have egg diameters greater than 4.00 mm by May 1st. The female has a maturity index of 2.00% or greater and the males usually greater than .80%. These values were used as the lower limits of spring maturation in other chinook fisheries during May and June.

During late July, a large sample was collected in the Golden North Salmon Derby. Over 99% of the females sampled had egg diameters of less than 2.24 mm. Excluding three definitely maturing chinook, the female maturity index varied between .19% and .72%, and the male index, .03% to .46%. These fish were all felt to be immature. All samples that fell between maturing springs and the immatures were considered to be fall spawners. Arbitrary separation was then made by inspection taking the difference in sampling dates into account. Results are presented in Tables 3, 4, 5.

Table 3. Separation of female immature and maturing spring and fall chinook in various fisheries by egg diameters.

Egg Diameters In Millimeters		Taku	Haines	Ketchikan	Sitka	Juneau Derby	Fairweather
.00- .99	Immature	0%	0%	0%	0%	1.2%	0%
1.00-1.99		0%	7.4%	15.8%	50.0%	71.2%	73.5%
2.00-2.24		0%	0%	0%	4.2%	27.0%	2.9%
2.25-2.49		0%	0%	0%	2.1%	0%	2.9%
2.50-2.99	Fall	0%	3.7%	5.3%	4.2%	0%	0%
3.00-3.49		0%	3.7%	5.3%	8.3%	0%	2.9%
3.50-3.99		0%	0%	10.5%	8.3%	0%	2.9%
4.00-4.99	Spring	36.4%	59.3%	15.8%	12.5%	0%	11.8%
5.00-5.99		48.5%	25.9%	31.6%	10.4%	0%	0%
6.00-6.99		15.2%	0%	15.8%	0%	.6%	2.9%
n =		66	27	19	48	163	34
Immature		0%	7.4%	15.8%	50.0%	99.4%	76.4%
Mature Fall		0%	7.4%	21.1%	27.1%	0%	20.5%
Mature Spring		100.0%	85.2%	63.2%	22.9%	.6%	2.9%

Table 4. Separation of Female Immature and Maturing Spring and Fall Chinook in Various Fisheries by Maturity Index.

Maturity Index%		Taku	Haines	Ketchikan	Sitka	Juneau	Fairweather
.00- .09	Immature	0%	0%	0%	0%	0%	0%
.10- .19	Immature	0%	0%	0%	0%	2.5%	2.9%
.20- .29	Immature	0%	3.7%	5.3%	0%	11.7%	5.9%
.30- .39	Immature	0%	0%	0%	14.6%	21.5%	35.3%
.40- .49	Immature	0%	3.7%	0%	20.8%	36.2%	20.6%
.50- .59	Immature	0%	0%	5.3%	14.6%	21.5%	11.8%
.60- .69	Immature	0%	0%	5.3%	2.1%	4.9%	2.9%
.70- .79	Fall	0%	0%	0%	2.1%	1.2%	0%
.80- .89	Fall	0%	0%	0%	4.2%	0%	2.9%
.90- .99	Fall	0%	3.7%	0%	0%	0%	0%
1.00-1.99	Fall	0%	0%	10.5%	16.7%	0%	11.8%
2.00-2.99	Spring	18.8%	11.1%	15.8%	10.4%	0%	0%
3.00-3.99	Spring	39.1%	33.3%	10.5%	8.3%	0%	5.9%
4.00-4.99	Spring	21.9%	33.3%	21.1%	6.3%	0%	0%
5.00-5.99	Spring	9.4%	11.1%	15.8%	0%	.6%	0%
6.00-6.99	Spring	7.8%	0%	10.5%	0%	0%	0%
7.00-7.99	Spring	3.1%	0%	0%	0%	0%	0%
n =		64	27	19	48	163	34
Immature		0%	7.4%	15.9%	52.1%	99.4%	79.4%
Mature Fall		0%	3.7%	10.5%	23.0%	0%	20.6%
Mature Spring		100.0%	88.8%	73.7%	25.0%	.6%	0%

Table 5. Separation of Male Immature and Maturing Spring and Fall Chinook in Various Fisheries by Maturity Index.

Maturity Index%		Taku	Haines	Ketchikan	Sitka	Juneau Derby	Fairweather
.00- .09	Immature	0%	11.8%	12.5%	37.5%	82.5%	66.7%
.10- .19	Immature	0%	0%	9.4%	21.9%	8.3%	0%
.20- .29	Fall	0%	5.9%	0%	25.0%	5.0%	4.8%
.30- .39	Fall	0%	0%	0%	0%	.8%	4.8%
.40- .49	Fall	0%	17.6%	0%	3.1%	1.7%	0%
.50- .59	Fall	0%	0%	6.3%	6.3%	0%	4.8%
.60- .69	Spring	2.1%	0%	9.4%	0%	0%	0%
.70- .79	Spring	2.1%	5.9%	3.1%	3.1%	0%	0%
.80- .89	Spring	8.5%	5.9%	0%	0%	0%	0%
.90- .99	Spring	4.3%	0%	3.1%	0%	0%	4.8%
1.00- 1.99	Spring	55.3%	23.5%	21.9%	3.1%	.8%	14.3%
2.00- 2.99	Spring	21.3%	17.6%	15.6%	0%	.8%	0%
3.00- 3.99	Spring	4.3%	11.8%	9.4%	0%	0%	0%
4.00- 4.99	Spring	2.1%	0%	3.1%	0%	0%	0%
5.00- 5.99	Spring	0%	0%	6.3%	0%	0%	0%
n =		47	17	32	32	120	21
Immature		0%	11.8%	21.9%	59.4%	98.3%	76.3%
Mature Fall		0%	23.5%	6.3%	34.4%	1.6%	23.9%
Mature Spring		100.0%	64.7%	71.9%	6.2%	0%	0%

Egg diameters are the best methods of maturity separation but a female maturity index was also calculated for comparison, in order to determine the accuracy of the male maturity information. It can be seen that the two methods of maturity designation in the females are in close agreement, except for the percentage of fall chinook in the Ketchikan area. This error may be partly due to small sample size.

It is felt that separation of maturing chinook of various subtypes, although somewhat arbitrary in this study because of limited sampling, is very possible if gonad samples are collected in various areas over an extended time period and compared.

Examination of gonads and collection of age-weight-length data throughout the season in areas such as the Fairweather grounds, where average weight is small, could be of benefit in determining if certain areas are nursery grounds for immature chinook.

Enzyme Analysis

Rearing chinook samples were collected in the Taku and Situk rivers in Southeast, and The British Columbia Department of the Environment will collect outmigrants this spring from the Big Qualicum, Cheakamus and Skeena rivers. Samples will be forwarded to the National Marine Fisheries Service for analysis.

Collections made in the Columbia River will then be compared to the British Columbia and Alaska samples to determine if significant varations in enzyme patterns occur between areas.

X-Ray Spectroscopy

Literature dealing with J. R. Calaprice's x-ray system was reviewed and correspondence exchanged. I feel that his system is still in the experimental stage and the Department of Fish and Game should not purchase the expensive electronic equipment necessary for analysis until the system is further developed and tested.

ENHANCEMENT

Various systems were investigated to determine if sufficient chinook populations occurred in some areas for egg takes or rearing fish transplants.

Situk River

Float trips were conducted in July and October to determine the status of the Situk River chinook stocks. Intensive minnow trapping was conducted throughout the watershed below Situk Lake and only about 30 rearing chinook were captured in five days of effort.

Alex Brogle, Area Biologist, indicated the 1972 escapement was less than 500, which is one of the lowest on record. The commercial harvest for 1972 was 303.

This stock is at a very low level of abundance and can withstand no increased utilization.

King Salmon River (Admiralty Island)

A foot survey of the King Salmon River was made in late July. The entire main river was surveyed; ninety adults were observed and five young of the year captured in minnow traps. This is a unique stock in that it is the only population of chinook that has adapted to an island watershed in Southeast. This small run of chinook should be protected.

Taku River

A foot survey of the Nakina River, a major tributary of the Taku, was made on August 8-10. Counts were made from Grizzly Bar to a point one mile above the Silver Salmon River. The enumeration was conducted during the peak of spawning activity and most fish observed were paired and digging redds. A total of 1,000 spawners were counted during the survey. This is the lowest ground count of this area on record.

Indications are that the Taku chinook stock has been severely depleted and it appears unwise to attempt to capture part of the escapement for egg takes.

Investigations will center this year on determining the feasibility of using gillnet caught chinook for a brood stock. Chinook in good condition after removal from gillnets will be transplanted to a holding pond and possibly artificially ripened by the use of hormones.

Behm Canal

Aerial surveys were conducted near the peak of chinook spawning activity in southern Southeast Alaska by Robert Baade, Area Management Biologist. Peak aerial estimates are presented in Table 6.

Conclusion

It appears that no spawning population of chinook in Southeast is of sufficient magnitude to warrant or justify an egg take or rearing fish transplant at the present time.

Table 6. Peak Aerial Estimates of the Chinook Escapement in Southern Southeast Alaska, 1972.

Peak Survey	Stream	Chinook
8/20	Grank Creek	25
8/9	Klahini River	150
8/9	Unuk River	655
8/20	Chickamin River	860
8/20	Wilson River	275
8/20	Blossom River	225
8/20	Keta River	255

AGE ANALYSIS

Introduction

Considerable controversy has existed in past years over the freshwater life history of chinook salmon in Southeast.

Parker et al (1954) interpreted from adult Taku River chinook scales that fry migrated to saltwater several weeks after emergence. This was the accepted theory until Meehan and Siniff (1962) examined outmigrant chinook from the Taku River and felt that they all had stream-type nuclei. Their sample indicated that 94% migrated in their second year of life as 1-checks, and the remainder, in their third year.

On examining 238 scales collected in the Taku River gillnet fishery, it appeared that they all had stream-type nuclei. To verify that the correct interpretation was being made, collections of rearing chinook were made in August on the Nakina River, which is a major clearwater triburary of the Taku. Forty-six scale samples were examined and circuli counts varied between four and seven with a mean of 5.50. Analysis of Taku River adults showed a range in freshwater circulus counts to the annulus of 7 to 14, with a mean of 9.56.

The average fork length of the samples collected in mid-August was 56.2 mm; the mean fork length of Meehan and Siniff's (1962) sample collected in April and May was 73.3 mm.

The comparison of circuli and length measurements indicate that most chinook rear for one year before seaward migration.

Gillnet Fisheries

Comparative age information of chinook salmon harvested in the Taku and Stikine River gillnet fisheries during 1972 is presented in Table 7. All age data collected by the Department of Fisheries for 1951 to 1958 was increased by one year as they interpeted that chinook migrated to the ocean shortly after emergence (Table 8a). Annual collection of age information should be of value in determining strong year classes, which may someday be used in predicting run size.

The eight to nine inch stretched mesh gillnets utilized until mid-June are highly selective to the older age classes. The majority of age classes III and IV, which are composed of a very high percentage of males, are able to escape through the large nets. The result is an overabundance of males on the spawning grounds and, in fact, from 1956-1958 when a carcass weir was operated on a major spawning tributary of the Taku River, there were always at least five time as many males as females. During ground observations on the Nakina in 1972 we also saw many more males than females.

Table 7. Age Analysis of Taku and Stikine River Gillnet Caught Chinook Salmon, 1972.

			TAKU			
Age	1.2	1.3	1.4	1.5	2.3	2.4
n	5	153	63	4	9	4
%	2.1	64.3	26.5	1.7	3.8	1.7
			STIKINE			
Age	1.3	1.4	2.3			
n	20	36	1			
%	35.1	63.2	1.8			

Table 8 (a). Age Analysis of Gillnet Caught Chinook Salmon in Taku Inlet by Percent.

	III	IV	V	VI	VII	Catch
1951	--	.1	17.2	80.6	2.1	9,790
1952	--	9.0	38.7	49.8	2.6	12,940
1953	--	2.9	49.3	45.2	2.6	16,780
1954	.8	10.0	22.3	64.9	2.1	14,335
1955	--	7.6	40.6	48.7	3.1	10,685
1956	.5	12.9	44.4	40.2	1.9	11,250
1957	--	6.6	45.4	46.3	1.8	8,482
1958	.4	12.3	52.8	33.3	1.2	15,343
1972	--	2.1	64.3	30.3	3.4	2,500

This excess of small males may be doing severe damage to the Taku and Stikine chinook stocks. Selective breeding studies conducted on the Deschutes River indicated chinook that mature at a younger age have a tendency to pass the trait to their progency (Ellis & Noble, 1969). Therefore over a period of time we may be drastically altering the age composition, sex ratio and reproductive potential of the run.

The Department of Fish and Game is presently attempting to obtain permission to build a carcass weir on the Nakina River to determine if the sex ratio is even more skewed than in the mid-1950's.

Troll Inside Waters

Scales samples were collected in the Ketchikan, Haines and Juneau Salmon Derbies in conjunction with reproductive tract collection. The samples from salmon derbies would be biased toward the older age classes, as there is a greater probability of a large fish being entered for possible prizes.

Analysis of scales showed that in the Haines and Ketchikan Derbies, which are held in late May and early June, maturing five and six year old fish were dominant (Table 8b).

The Juneau derby sample was composed of younger age classes (Table 8b), as the native spawning runs have completed upstream migration by the time the derby is held in late July.

Age analysis of saltwater sport-caught chinook in the Juneau area is presented in Table 9. Since there is no minimum size in the sport fishery, this sample is probably representative of the available population.

Finger and Armstrong (1965) interpreted scales collected in the Juneau sport fishery in 1960 and 1961. At that time, controversy over freshwater age existed, so their analysis included only the number of ocean checks on a scale. During this time period a 26-inch (FL) minimum was in effect. For comparative purposes, all samples less than 26 inches (FL) were eliminated and the data summarized by number of years spent at sea (Table 10).

Troll Outside Waters

In the outside waters of Southeast Alaska, scale samples were collected during the Sitka Salmon Derby in mid-June, and aboard a commercial troller on the Fairweather grounds in early August.

Table 8 (b). Age Analysis of Sport Caught Chinook Salmon in the Ketchikan, Haines and Juneau Salmon Derbies, 1972.

KETCHIKAN

Age	0.3	0.4	1.2	1.3	1.4	1.5
n	2	3	13	50	29	1
%	2.0	3.1	13.3	51.0	29.6	1.0

HAINES

Age	1.2	1.3	1.4	1.5
n	2	10	29	6
%	4.3	21.3	59.6	14.9

JUNEAU

Age	0.2	0.3	0.4	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3
n	1	9	1	3	98	157	3	0	1	0	3
%	.4	3.3	.4	1.1	35.5	56.9	1.1	0	.4	0	1.1

Table 9. Age Composition of the Sport Gear Caught Chinook Salmon in the Juneau Area, 1972.

Age	0.2	0.3	1.1	1.2	1.3	1.4	1.5	2.1	2.2
n	2	3	7	64	39	5	2	1	3
%	1.6	2.4	5.6	50.8	31.0	4.0	1.6	.8	2.4

Table 10. Ocean Age Composition of the Sport Gear Caught Chinook Salmon in the Juneau Area, 1960, 1961 and 1972.

	1	2	3	4	5	6	n
1960	0%	36.0%	46.0%	18.0%	0%	0%	825
1961	1.0%	20.0%	61.0%	17.0%	1.0%	0%	589
1972	0%	23.0%	66.0%	8.0%	3.0%	0%	62

Table 11. Age Composition of Chinook Salmon Caught in Outside Waters of Southeast Alaska 1972.

FAIRWEATHER GROUNDS

Age	0.2	0.3	1.1	1.2	1.3
n	15	24	3	20	8
%	21.4	34.3	4.3	28.6	11.4

SITKA DERBY

Age	0.3	0.4	0.5	1.2	1.3	1.4	1.5
n	26	13	1	6	20	7	2
%	34.7	17.3	1.3	8.0	26.7	9.3	2.7

Analysis indicates that fall chinook which all originate to the south utilize the outside waters to a high degree (Table 11). This is in contrast to the inside samples from Haines, Ketchikan and Juneau where less than 5 percent were classified as fall chinook.

LITERATURE CITED

Bohn, B. R. and H. E. Jensen. 1971. Investigations of the scale patterns as a means of identifying races of spring chinook salmon in the Columbia River. Fish Comm. Oregon Res. Report Vol. (3) pp 28-36.

Clutter, R. I. and L. E. Whitesel. 1956. Collection and interpretation of sockeye salmon scales. Int. Pac. Salmon Fish. Comm. Bull. 9. 159 pp.

Ellis, C. H. and R. E. Noble. 1961. Returns of marked fall chinook salmon to the Deschutes River. Deschutes River genetics experiment. Wash. State Fisheries Dept. Ann. Rept. For 1960, 70: 72-75.

Finger, G. and R. Armstrong. 1965. The age composition of king salmon caught on sport fishing gear in southeastern Alaska. Alaska Department of Fish and Game Informational Leaflet No. 60, 16 pp.

Henry, K. A. 1961. Racial identification of Fraser River sockeye salmon (Oncorhynchus nerka Walbaum) by means of scales and its application to salmon management. Ph. D. Thesis, Univ. Wash., Seattle. 192 pp.

Isakssoni, A. 1970. Discrimination of Fraser River and Lake Washington sockeye salmon by means of scale characters. Masters Thesis, Univ. Wash., Seattle. 94 pp.

Meehan, W. R. and D. B. Siniff. 1962. A study of the downstream migrations of anadromous fishes in the Taku River, Alaska. Trans. Amer. Fish. Soc. (91)(4): 399-407.

Mosher, K. H. 1963. Racial analysis of red salmon by means of scales. Int. N. Pac. Fish. Comm. 11: 31-45.

____________________. 1972. Scale features of sockeye salmon from Asian and North American Coastal regions. Fish Bull: Vol. 70(1).

Parker, R. R. and W. Kirkness. 1956. King Salmon and the ocean troll fishery in southeastern Alaska. Alaska Dept. of Fisheries, Research Report, No. 1, 63 pp.

Parker, R. R., W. Kirkness, K. N. Thorson, Q. A. Edson, and E. J. Huizer. 1954. 1953 Annual Report, Alaska Fisheries Board and Alaska Dept. of Fisheries (Report No. 5).

Rich, W. H. 1925. Growth and degree of maturity of chinook salmon in the ocean. Bull. Bur. Fish. Vol. 41: 15-90.

Rowland, R. G. 1963. Comparison of morphological characters of king salmon (Oncorhynchus tshawytscha) from four Alaska and one Washington River. U.S.F.W.S. Manuscript Report.

____________________. 1969. Relation of scale characteristics of river of origin in four stocks of chinook salmon (Oncorhynchus tshawytscha) in Alaska. U.S.F.W. Spec. Sci. Rep. Fish. 577: 1-6.

Prepared by:

Paul D. Kissner, Jr.
Fishery Biologist

Approved by:

s/Howard E. Metsker
D-J Coordinator

s/Rupert E. Andrews, Director
Division of Sprot Fish